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ABSTRACT

The study investigated whether training in object permanence and/or means-end followed by a language training program will result in the learning of more langage (as measured by number of words and syntactic complexity) than the language training program alone with 32 profoundly retarded children (3 to 10 years old). Secondary goals included determining which of the cognitive training programs is most easily learned, which of the cognitive training programs leads to the most effective learning of language, which of the cognitive training programs has the most transfer to other types of sensorimotor period intelligence, and which, if any, of the cognitive training programs results in the reduction of, or the advancement through a sequence of, circular reactions. Ss were divided into four groups--two groups receiving cognitive training followed by language training, a group receiving just language training, and a control group. Results from the second year of the 3 year study indicated that both of the cognitive training procedures have prepared the majority of the children in those conditions to learn some speech. Ss in the language training only group have not achieved as much as Ss who received either object permanence or means-end training first. (SB)

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Training Sensorimotor Period and Language Skills with Severely Retarded Children

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INTRODUCTION

The study presented here is part of a three year project which is nearing the end of its second year. The first two years are the intervention phase with the third year being used to follow-up on the durability and generalization of the skills learned in the first two years of intervention. Thus, the data presented at this time are not final and are interpreted cautiously.

Review of the Literature

Although Piaget's own work has been with individuals of average or above average intelligence, there exists a large body of literature which has focused on demonstrating the utility of Piaget's theory with mentally retarded persons. Until recently, most of the research on this topic dealt with mildly retarded children and adolescents. In the last few years, however, there have been a number of published research reports which have dealt with the relationship of Piaget's theoretical formulations to severely and profoundly retarded persons. I have reviewed much of this research elsewhere (Kahn, 1979, in preparation) and will only give a brief overview here.

There are four major periods of cognitive development in Piaget's theory: sensorimotor, preoperational, concrete operations, and formal thought. However, only the sensorimotor period is pertinent to the present discussion because profoundly retarded individuals do not achieve a more advanced level of cognitive functioning according to Inhelder (1943/1968) and Piaget (1943/1968). While research cannot confirm this beyond any doubt without studying all profoundly retarded persons and having an agreed upon definition of profound retardation, there does appear to be evidence that if not all, then a very large number of profoundly retarded children and adolescents appear to be functioning at the sensorimotor period (e.g., Kahn, 1976; Rogers, 1977; Woodward, 1959).

This is not to say that techniques might not be developed to help profoundly retarded persons to achieve a higher level of functioning. As a matter of fact, this is the major long-range goal of this research project. However, at present, profoundly retarded individuals do appear to fixate at the sensorimotor period if there is no program of cognitive intervention specifically aimed at preventing fixation.

Woodward (1959) first demonstrated that many profoundly retarded children and adolescents could be identified as functioning at one of the six stages of Piaget's sensorimotor period. This study was important for a number of reasons. It was the first study since Inhelder's 1943 dissertation which suggested the applicability of Piaget's theory of cognitive development with retarded persons. More important to the present discussion, Woodward's findings extended Inhelder's research, indicating that Piaget's sensorimotor period is as relevant to the assessment of low functioning retarded individuals as Inhelder's research had indicated the higher stages of Piaget's theory were relevant to moderately and mildly retarded persons. In addition, Woodward's study utilized Piaget's sensorimotor period to explain some of the bizarre appearing behaviors of her subjects.

Woodward studied the repetitive hand mannerisms of profoundly retarded children and adolescents and clearly demonstrated that some of these purposeless and bizarre appearing behaviors are understandable in terms of Piaget's sensorimotor period. For instance, a child holding his hand at face level and intently looking at it while moving his fingers or opening and closing his hand could be demonstrating a primary circular reaction.[1] This behavior, while appearing very strange in an older retarded individual, is perfectly normal and expected of an individual functioning at stage two of the sensorimotor period. Similarly, repetitive banging, shaking or hitting of objects

could be representative of a secondary circular reaction[2] (stage three) and repetitive dropping from various heights or banging on various surfaces of an object could be representative of a tertiary circular reaction[3] (stage five). These seemingly strange behaviors, and others, are to be expected of severely and profoundly retarded individuals, who are functioning within the sensorimotor period, and should not be viewed as bizarre. Quite the contrary, these behaviors should be viewed as <u>possibly</u> indicating the stage at which an individual is functioning cognitively. The emphasis on the word "possibly" is essential. It is equally possible that the bizarre appearing behavior is just what it appears to be, a stereotypic behavior which needs to be extinguished. What I am suggesting is that scales of sensorimotor period development do exist, in particular <u>Assessment in Infancy</u> (Uzgiris and Hunt, 1975), which can be used to assess a retarded individual's stage of sensorimotor period (Dunst, 1980; Kahn, 1976). Since the Uzgiris and Hunt instrument consists of seven parallel scales, six of which are relatively independent of the stereotypic behaviors often exhibited by severely and profoundly retarded persons, it can be used to determine if the behaviors are indicative of the individual's stage of cognitive functioning or are inappropriate behaviors which should be extinguished and replaced by more suitable behaviors. That is, a profoundly retarded child who is hand watching may be performing a primary circular reaction or merely a repetitive, meaningless behavior, depending upon his/her stage of cognitive functioning. The Uzgiris and Hunt scales can be used to determine the child's level of cognitive functioning and, thereby, determine if the behavior is appropriate or inappropriate for the child.

Assuming that there are severely and profoundly retarded children whose repetitive mannerisms can appropriately be classified as primary, secondary, or tertiary circular reactions, then it is necessary and desirable that we

develop methods of training by which these children can advance through the sensorimotor period more rapidly than they are presently doing. A secondary goal of the proposed research is to see if training in object permanence and/or means-end will generalize to the children's schemes for relating to objects. If this generalization does occur, it will effect changes in the child's circular reactions since these are a major aspect of the way that sensorimotor period children relate to objects. If this generalization does not occur, it would be necessary, through future research efforts, to develop other, perhaps more direct, methods for effecting the child's rate of developing schemes for relating to objects.

The concept of readiness is probably the single most important aspect of Piaget's theory for the educator. Piaget (1964, 1970) contends that development must precede learning. That is, there are particular cognitive structures (e.g., order and correspondence which evolve during the sensorimotor period) which are necessary for the learning of particular skills (e.g., speech). Therefore, the ability to assess which cognitive structures an individual possesses could be very important in determining which skills should be taught to that individual. Since cognitive structures are obviously not directly observable, we must infer the existence of these structures from the individual's performance on cognitive tasks such as the Uzgiris and Hunt (1975) scales.

Language is one important curriculum area for low functioning retarded children in which Piaget's theory could play an important role. There have been numerous seemingly successful attempts using operant conditioning techniques, to develop speech with severely and profoundly retarded children who have never exhibited speech. Sailor, Guess, and Baer (1973) reviewed many of

these attempts and pointed to the one serious limitation common to all of them. While most of the subjects developed some speech, the studies have failed to demonstrate generalization so that, after the training program was completed, the children continued to learn more vocabulary and improve their grammatical structure. Sailor, et al. went on to suggest that this can be corrected through still more operant conditioning. They totally ignore the possibility that the children did not generalize because they had been taught only to respond on cue and were not cognitively ready to develop speech.

Several recent publications (Bates, 1976; Bates, Camaioni & Volterra, 1975; Bowerman, 1976; Corrigan, 1979; Ingram, 1979; Kahn, 1975, 1979; Leonard, 1978; Moerk, 1975, 1976; Morehead and Morehead, 1974; Piaget, 1979; Sinclair, 1971, 1975) have indicated an apparent relationship between sensorimotor period functioning and speech. These publications have all suggested that referential speech does not develop until the last stage (stage 6) of the sensorimotor period. Two of these articles are particularly important because of the data which they have collected. Bates, et al. (1975) conducted a longitudinal study with a small number of infants. Their findings clearly indicated that referential use of speech did not occur until stage six of the sensorimotor period and that it did occur at that stage with their sample.

Kahn (1975) studied eight profoundly retarded children who could express themselves verbally (at least ten words) and eight profoundly retarded children who had never demonstrated speech. The children's scores on the Uzgiris and Hunt scales indicated that the verbal children had all attained stage six. These findings were interpreted as indicating support for the hypothesis that stage six of Piaget's sensorimotor period is necessary, though not by itself sufficient, for the acquisition of speech.

If, as these findings seem to indicate, the cognitive structures which develop during stage six of Piaget's sensorimotor period are necessary for the acquisition of referential speech, then training of nonverbal profoundly retarded children to develop speech should begin with an assessment of their cognitive level. According to this position, those children who are at stage six could then reasonably be expected to learn language skills with relative ease and operant techniques would appear appropriate for training them. However, those children who are not functioning at stage six would not be expected to learn to speak with any reasonable degree of efficiency. These children would probably benefit more from training activities directed toward accelerating their rate of cognitive development. After the children are functioning at stage six, it would then be reasonable to expect them to learn language from operant procedures with a much higher degree of efficiency. First, however, it is necessary to demonstrate that severely and profoundly retarded children can benefit from cognitive training procedures and that the benefit will include more readily learned speech. Brassell and Dunst (1976) report on an attempt to train severely retarded children to more rapidly acquire the object permanence construct. While the two training procedures they used resulted in a fast and significant acquisition of object permanence, long term retention of this construct was not evidenced by the children. The lack of long term retention could be due to the somewhat brief training period, only eight sessions of ten minutes each.

In a recently completed dissertation, Henry (1977) demonstrated both durability and generalization of her training procedures. In this study, the subjects were 57 mentally retarded children between 6 and 24 months of age. For 12 weeks the children received training in object permanence, vocal imitation, and gestural imitation from their parents. Following the training

period, the children demonstrated significant improvement on all three of the Uzgiris and Hunt scales of the same names. They also demonstrated significant improvement on three other Uzgiris and Hunt scales for which they received no training: Development of Means, Development of Causality, and Construction of Object Relations in Space. Thus, this study demonstrated generalization of the training to scales on which there was no training. Henry also demonstrated durability of training by giving a second post-test six weeks after the training was completed. The children maintained their gains on all three of the trained scales.

Kahn (1978) also attempted to accelerate the development of object permanence of severely and profoundly retarded children. In this study four low functioning retarded children were trained for six months. At the end of this time, all four of the trained subjects demonstrated large improvements in object permanence and smaller improvements in other areas of sensorimotor development while their controls demonstrated no improvement. A follow-up of these children twelve months later indicated a large degree of retention. These three studies (Brassell & Dunst, 1976; Henry, 1977; Kahn, 1978) seem to indicate that direct training can effect the rate of cognitive development of low functioning retarded children.

Another study (Kahn, 1977a) using some of the same children from the above cited (Kahn, 1978) study indicated that the learning of object permanence may be important for the future learning of language. In this study, two of the trained subjects, who were functioning at stage six of the sensorimotor period, and two of their controls who were functioning below stage six (from the 1978 study), were matched with two other children who had attained stage

six with no direct training in this area. All six children were given individual language training for eight months. The findings clearly indicate that those children at stage six, with or without the object permanence training, learned far more in the language program than the children who were below stage six. Specifically, the four stage six children had each learned to independently produce at least 13 words while the two control subjects were still engaged with prelingual training phases. Unfortunately, there were some problems with this study, including the small number of subjects, which precludes making generalizations beyond these subjects. Thus it is very important to replicate and expand this study.

Significance

The present study has both theoretical and practical levels of significance. The theoretical importance of this study relates to the validity of Piaget's theory. Piaget argues that training of cognitive structures may be possible but is not advisable because of future complications. Piaget believes that a child who has been pushed to develop cognitive structures will not have learned them as well as children who have developed them in a more "natural" manner and that this will have implications for the later learning of skills and other cognitive structures which are based upon these cognitive structures. If he is correct about the effects of training cognitive structures, we would expect the 16 children who will receive cognitive training to show little or no benefits from such training when they enter a language training program. Kahn (1977a), in a pilot study for this project, disputes Piaget's contention. He shows some, though admittedly a small amount of, evidence that subjects who have received training so as to increase their cognitive structures, do as well in a language training program as subjects who had achieved the same level of

cognitive functioning without any special training. The present study, though not a replication of the Kahn (1977a) study, should add support or question Kahn's supposition that cognitive training is pertinent to the later learning of language.

The practical importance of this study is more obvious and probably of more importance to an agency that has responsibility for large numbers of severely and profoundly retarded clients. If it is found that the children who received either sort of cognitive training learned to use more language and more complex syntactic structures than the group who received training in language for the entire period of the study, the entire approach to language training presently in use should be changed. It would become obvious that children below a certain cognitive level should receive cognitive training, of a type to be determined by this and future studies, prior to language training. Thus, each severely or profoundly retarded, nonverbal child would be assessed using the Uzgiris and Hunt scales and then assigned to either a cognitive or language training program depending upon their cognitive level.

Obviously, all of this will not result from this one study. However, if this study is successful in demonstrating the utility of cognitive training, it will open the door to further investigation in this area. Only two of the six types of sensorimotor period intelligence are involved in training, object permanence and means-end. These were selected because this writer believes in their theoretical importance to language acquisition. However, I admit the possibility that other areas of the sensorimotor period may be more important (e.g., the Development of Causality) to the learning of language. Thus, if this study is successful, future research will be directed at refining our knowledge so as to better understand the relationship of the various types of

sensorimotor intelligence and how these relate to the later learning of language and perhaps other skills.

Specific Aims

The present research is an attempt to systematically study the effects of two different training programs which are designed to accelerate the rate of cognitive development of profoundly retarded children who are functioning at the sensorimotor period. The major question, which this study will answer, is whether training in object permanence and/or means-end followed by a language training program will result in the learning of more language (as measured by number of words and syntactic complexity) than the language training program alone. This study, in the proposed third year, will also investigate the durability and generalization of the training to other situations and continued learning.

Secondary goals will include:

1. Determining which of the cognitive training programs is most easily learned;
2. Determining which of the cognitive training programs leads to the most effective learning of language;
3. Determining which of the cognitive training programs has the most transfer to other types of sensorimotor period intelligence (i.e., Vocal Imitation, Gestural Imitation, Development of Causality, Construction of Object Relations in Space; and Development of Schemes for Relating to Objects); and
4. Determining which, if any, of the cognitive training programs results in the reduction of, or advancement through the sequence of, circular reactions.

METHOD

Subjects

The subjects consist of 32 profoundly retarded children with chronological ages between three and ten years of age at the beginning of the study. The American Association on Mental Deficiency definition of profound retardation was used in this study (Grossman, et al., 1973). All of the subjects were functioning cognitively within the sensorimotor period as measured by Uzgiris and Hunt (1975) scales and attend one of three schools in Chicago.

The etiologies of the subjects are mixed with no more than 35% of any single etiology. None of the subjects exhibited any form of expressive communication (i.e., speech, sign language, Bliss Symbolics, etc.) prior to this study or had any sensory impairment which would make it difficult, or impossible, for them to learn to speak. In addition, while the subjects' mobility may be limited, they are all able to control at least one arm well enough to perform the object permanence and means-end tasks required of them.

Due to the relatively small sample size, the subjects were matched according to age, etiology, and scores on the Uzgiris and Hunt scales, and assigned to one of four groups.

Procedures and Instrumentation

All of the subjects were individually assessed with three instruments: Assessment in infancy (Uzgiris and Hunt, 1975): Bayley scales of infant development (Bayley, 1969); Bricker, Dennison, and Bricker (1976) behavior probes of linguistic and prelinguistic behaviors. In addition, they were assessed at the end of the first year of the study and at the end of the cognitive training phase. They will be assessed again at the conclusion of the second year of the study. The third year of the project will consist of a follow-up study to determine the durability of the training effects.

The Uzgiris and Hunt instrument consists of six parallel scales which measure moderately correlated aspects of Piaget's sensorimotor theory. The six scales are: Development of Visual Pursuit and the Permanence of Objects (hence referred to as Object Permanence), Development of Means for Obtaining Desired Environmental Events (hence referred to as Means-end), Development of Imitation (which is divided into two parts, Gestural Imitation and Vocal Imitation); Development of Operational Causality, Construction of Object Relations in Space, and Development of Schemes for Relating to Objects. Uzgiris and Hunt have developed a scoring system which ignores Piaget's six stages and is, in fact, more finely graded (e.g., Uzgiris and Hunt have 14 steps for Object Permanence which encompass Piaget's stages two through six). However, if one wished to convert the Uzgiris and Hunt scores to Piagetian stages, this can be done by returning to Piaget's original writings on the appropriate topics to find the stage for each behavior of type of behavior. For instance, anyone familiar with Piaget's sensorimotor theory would recognize that invisible displacements in object permanence tasks requires stage six functioning. Thus, the Uzgiris and Hunt scores 9 through 14 on object permanence are all representative of stage six functioning. For those not wishing to read Piaget's original work, Dunst (1980) has recently indicated the appropriate stage for each of the Uzgiris and Hunt items. Bayley's (1969) Scales of infant development are also administered to each subject. This test was developed as an infant intelligence test but, because of its developmental characteristics, has often been used with severely and profoundly retarded persons who are cognitively functioning below approximately 30 months of age.

The third assessment used in this study will be the behavioral probes devised to be used with the Bricker, Dennison, and Bricker (1976) language

training program. The language training program consists of 26 phases of training from sitting and eye contact to the production of three word phrases (See Table 1 for a listing of these phases). Each of the training phases has a behavior probe which is used to determine which phase of training the child is learning. Since this is the language training program to be used in this study, and since there exists no commonly agreed upon test for assessing pre-linguistic and linguistic skills, this procedure has been adopted for this study.

The order of assessment for each child is the same. The Bayley (1969) scales are administered first in one session; the Uzgiris and Hunt (1975) scales are administered next in two sessions; and the language probes are administered last in one or two sessions depending upon the child's level of skill.

The four groups of eight subjects each consist of two groups receiving different cognitive training programs followed by language training, a group receiving just the language training, and a control group. The two cognitive training programs consist of individualized training in object permanence and means-end. Each of these training programs consist of a concentrated, often highly directed, effort to have the child improve his performance in the area being trained. Primary (when necessary) and secondary positive reinforcements are used as required to keep the child interested in the tasks. The steps followed in the training procedures follow the same order as the Uzgiris and Hunt scales of the same name. Training began with the lowest scale step on which the child could not demonstrate criterion. The criterion for each step is considered achieved when the subject demonstrates successful performance on that step, with no errors, for two consecutive sessions. Training then continues to the next step through successive approximations of that step. If repeated

efforts on the next step are unsuccessful, overlearning of the preceding step is implemented. The procedures used for object permanence training are the procedures described by Kahn (1977b) and found to be at least moderately successful (Kahn, 1978). The procedures used for means-end training have been developed for the present study. These procedures, which have undergone a good deal of revision in the last 18 months, will be in the final report of this project.

Each of the subjects in the two cognitive training groups begin language training when s/he achieves the criteria for that cognitive training program. The criteria consists of the highest item on the Uzgiris and Hunt scale for which the subject receives direct training. That is, successful performance on the highest object permanence item is the criterion for the subjects in the object permanence training condition while successful performance on the highest item on the means-end scale is the criterion for the subjects in the means-end training condition.

The language training program for those subjects in the language training condition and for the subjects completing the cognitive training condition is the one developed by Bricker, Dennison, and Bricker (1976). This program consists of 26 phases of training (the phases are presented in Table 1). This language training program was constructed to represent the normal language learning process. Operant procedures are used as necessary and behavioral probes are administered every two weeks in order to determine the progress being made by the subject. The probes consist of the trainer requesting the subject to demonstrate the skills which have been taught. For instance, if a subject has been working on the production of nouns, the trainer might ask, "What is this?" while pointing at one of three objects in front of the child.

Reliability of these probes was measured earlier in this study and found to range between 91 and 98 percent agreement between two observers. In addition, data is collected daily in each subject's training session. Each subject begins the language training at the most appropriate phase for that subject based upon the baseline probe given just prior to the initiation of language training.

Each of the 24 subjects in the cognitive or language training conditions receives individual training for 20 minutes a day, five days a week during the first two years of the project. The eight control group subjects are tested only three times and will receive only such training as is normal at their school.

The trainers are three graduate research assistants with prior experience working with severely and profoundly retarded children. They received one month of training from the principal investigator prior to the project and frequent visits from the principal investigator during the project. They were not involved with testing the children with whom they are working.

The third and final year of this project is designed to determine the durability and generalizability of the two years of training. During this year, each of the subjects will be observed in various activities (e.g., various training activities, lunch, with and without an adult in immediate proximity) in their schools. The observations will take particular note of the communicative behaviors and the frequency and type of any stereotypes. In addition, periodic language probes, based on the Bricker, Dennison, and Bricker program, will be administered to each subject. Finally, a complete assessment will be administered in June, 1982.

The observations and probes will take place approximately every three weeks. Since there will only be one observer who will also administer the probes, it will be necessary to have him spend one week in three at each of the three sites. During that week, he will administer a language probe to each child and observe each child for a total of 2 hours, divided into four 30 minute observation sessions. The four observation sessions of each child will occur on different days of the week and at different times of the day. This will permit us to observe the most comprehensive selection of behaviors possible. The observation protocol is presently being designed and will be checked for reliability (and modified as necessary) during the summer.

RESULTS AND DISCUSSION

As of this writing, the subjects have been receiving training for approximately 18 months. Although it is not, as yet, possible to report any definitive results or discuss data in terms of support for, or rejection of, the hypotheses, it is possible to describe the progress made by the subjects to date and discuss the relative improvements made by the three training groups.

The object permanence training procedure has 14 steps with individuals beginning training anywhere from step 1 to step 14 depending on their existing level of functioning. The beginning step (as of 9/79) the step at the end of the first year (6/80), and the present step on which each subject is receiving training (3/81) are given in Table 2. As can be seen, three of the subjects had completed the object permanence training and begun the language training by the end of the first year's funding and the other five subjects completed the object permanence training and began the language training since then. Thus, the object permanence training was successful in raising the subjects' level of cognitive functioning in this area.

Of the eight object permanence trained subjects, five have not, as yet, achieved the criterion on any of the speech phases (phases 15-26). However, two of these subjects are working on the last phases of prelingual training and should be in the speech phases before the end of this year's funding and two others have passed the last prelingual phase and are receiving training on the initial speech phases. Two of the subjects in this group have completed the imitation and comprehension of nouns phases and are presently independently producing six and eight nouns, respectively. The eighth subject in this group has completed the production of ten nouns in phase 17 and also uses two verbs for a total of 12 words produced independently.

The means-end training procedure has 13 steps with individuals beginning training anywhere from step 1 to step 13 depending on their existing level of functioning. The beginning step, the step at the end of the first year's funding (6/80), and the present step on which each subject is receiving training are given in Table 2. As can be seen, five of the subjects had completed the means-end training and begun the language training by the end of the first year's funding with an additional subject achieving this level since then. Two subjects are still receiving training on the means-end tasks. While these two subjects are near completion of this training, their progress has been so slow that they may not complete this aspect of training before the end of training at the end of the second year's funding. Thus, the means-end training has not been as successful as the object permanence training in raising the subjects' cognitive level.

However, the language learned by the six successful means-end trained subjects exceeds that learned by the object permanence trained subjects. Only one of these subjects has not, as yet, achieved the criterion on any of

the speech phases and he has completed the prelingual phases and is receiving training on the initial speech phases. The other five successfully trained means-end subjects are currently independently producing between 11 and 23 words. In addition, one of these subjects is also independently using three two-word phrases.

The subjects in the language training only group have not achieved as much as the subjects who received either object permanence or means-end training first. As can be seen from Table 2, none of these eight subjects has yet even begun training on any of the speech phases, and only one is close (working on phase 14). Thus, it seems clear that both of the cognitive training procedures have prepared the majority of the children in those conditions to be able to learn some speech. The next four months of training (the data reported here are as of the end of February, 1981) will probably make this distinction even clearer.

The final year of this project is in many ways the most crucial. While the data thus far is encouraging, unless the better language performance is found to be durable, after the training program ceases, the current gains are unimportant. Similarly, the current gains are unimportant unless the children use the language learned in other than controlled testing situations. The third and final year of this project will test for the durability and generalizability to other situations of the gains made by the subjects. Only then will there be sufficient data to make statements regarding the overall, and relative, success of the cognitive training programs.

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Table 1

Phases of Language Training[a]

Phase 1:	Sit in Chair
Phase 2:	Eye Contact
Phase 3:	Work on Task
Phase 4:	Increase Vocalization
Phase 5:	Early Gestural Imitation
Phase 6:	Gestural Imitation of Familiar Actions
Phase 7:	Gestural Imitation of Unfamiliar Actions
Phase 8:	Sound Imitation - Child Initiated
Phase 9:	Sound Imitation of Familiar Sounds
Phase 10:	Sound Imitation of Unfamiliar Sounds
Phase 11:	Early Word Recognition
Phase 12:	Functional Use of Objects
Phase 13:	Appropriate Use of Objects
Phase 14:	Verbal Imitation of Component Sounds
Phase 15:	Imitation of Nouns (Criterion is 10 Nouns)
Phase 16:	Comprehension of Nouns (Criterion is 10 Nouns)
Phase 17:	Production of Nouns (Criterion is 10 Nouns)
Phase 18:	Imitation of Verbs (Criterion is 10 Verbs)
Phase 19:	Comprehension of Verbs (Criterion is 10 Verbs)
Phase 20:	Production of Verbs (Criterion is 10 Verbs)
Phase 21:	Imitation of 2-word Phrases (Criterion is 10 2-word Phrases)
Phase 22:	Comprehension of 2-word Phrases (Criterion is 10 2-word Phrases)
Phase 23:	Production of 2-word Phrases (Criterion is 10 2-word Phrases)
Phase 24:	Imitation of 3-word Phrases (Criterion is 10 3-word Phrases)
Phase 25:	Comprehension of 3-word Phrases (Criterion is 10 3-word Phrases)
Phase 26:	Production of 3-word Phrases (Criterion is 10 3-word Phrases)

a. Adapted from Bricker, Dennison & Bricker, 1976.

Table 2

Highest Cognitive and/or Language Phases "Passed" at the Beginning (9/79) Midpoint (6/80) and Current Date (3/81) of Training

Subjects	9/79	6/80	3/81
Object Permanence Group			
1	4	9	Language #9
2	2	Language #6	Language #13
3	9	Language #7	Language #16
4	4	10	Language #14
5	5	10	Language #14
6	4	13	Language #16
7	4	Language #6	Language #17
8	2	10	Language #13
Means-End Group			
1	7	Language #6	Language #17
2	2	8	11
3	5	10	12
4	8	Language #9	Language #19
5	10	Language #8	Language #20
6	10	Language #9	Language #17
7	9	Language #9	Language #17
8	4	11	Language #14
Language Group			
1	1	9	11
2	1	11	13
3	1	2	6
4	1	2	6
5	1	2	5
6	1	6	9
7	1	2	5
8	4	5	9

Footnotes

1. Piaget observed behaviors by young infants (approximately one to four months of age) which he termed primary circular reactions. The infant, apparently by chance, creates a movement which he/she finds interesting. He/she immediately, and repetitively attempts to repeat the behavior. Hand watching is such a behavior. The infant notices his hand moving in front of his face and attempts to repeat the movement.
2. While a primary circular reaction is always centered around the infant's own body, a secondary circular reaction involves objects in the child's environment. These behaviors occur later (approximately four to ten months of age) but are similar in that the child, by chance, causes somthing to occur, here with an object. He/she finds this action to be interesting and attempts to repeat it. Shaking a rattle is such a behavior. The child, by chance, moves the rattle and hears the sound it makes. He/she finds this interesting and attempts to recreate the behavior.
3. Tertiary circular reactions occur somewhat later than primary or secondary circular reactions (12 to 18 months of age). Tertiary circular reactions occur when the child, apparently intentionally, searches for novelty in the results of his behaviors. Dropping an object on a variety of surfaces and/or from varying heights is such a behavior. The child observes the varying results of his/her actions and continues to repeat the behavior with modifications designed to produce novel results.